Regional center for complex colonoscopy: yield of neoplasia in patients with prior incomplete colonoscopy

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Abstract

Background and Aims

Incomplete colonoscopy increases the risk of incident proximal colon cancer post colonoscopy. Incomplete colonoscopy is often followed by barium enema or CT colonography. We sought to describe the yield of completion colonoscopy in a regional center for complex colonoscopy.

Methods

This is a retrospective cohort study of 520 consecutive patients referred to a single colonoscopist over a 14 year period for completion colonoscopy after a previous incomplete exam.

Results

Colonoscopy was completed to the cecum in 506 of 520 patients (97.3%). A total of 913 conventional adenomas were removed in 277 patients (adenoma detection rate 53.3%). There were 184 adenomas ≥ 1 cm in size or with advanced pathology. There were 525 serrated class lesions removed in 175 patients, including 54 sessile serrated polyps in 26 patients and 41 hyperplastic polyps greater than 1 cm in 26 patients. Nine colorectal cancers were found. We estimated that approximately 57% of the conventional adenomas, 58% of the sessile serrated polyps, 27% of the hyperplastic polyps, and all 9 cancers detected by the completion colonoscopy were beyond the extent of the previous examination.

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Conclusions

The yield of completion colonoscopy in a cohort of patients with previous failed cecal intubation was substantial. Regional centers for complex colonoscopy can provide high rates of cecal intubation in cases of incomplete colonoscopy and high yields of lesions in these cases. The regional center for complex colonoscopy is an important medical service.

Introduction

Quality guidelines recommend that colonoscopists achieve cecal intubation in at least 90% of all colonoscopies and 95% of screening examinations.[1,2] Interval proximal colon cancer is more common when the cecum is not intubated.[3]

When colonoscopy is incomplete, barium enema or computerized tomographic (CT) colonography are commonly used to examine the colon proximal to the extent reached by colonoscopy. Capsule colonoscopy has been recently approved by the US Food and Drug Administration for this indication, and initial evidence indicates that capsule colonoscopy performs well for polyp detection in this situation.[4]

However, a repeat colonoscopy done by an expert endoscopist avoids radiation exposure and allows for therapy in a single procedure. Our center has the largest reported experience in performing colonoscopy in patients with previous incomplete examinations by other physicians.[5,6] We have described techniques used to achieve a 96% cecal intubation rate in 345 patients referred after failed colonoscopy by other physicians, and emphasized the value of water immersion during insertion, particularly in patients with redundant colons.[7-9]

In this report we assess the value of a regional center for complex colonoscopy specifically with regard to completion of previously failed colonoscopies. The impact and benefit of completing colonoscopy in patients with previous incomplete examinations may seem obvious for many patients, but has not been described in detail. Increasingly, regional centers for performance of challenging colonoscopies are being described.[10-14] In order to better understand the impact of a

regional center of expertise in colonoscopy on patients with prior incomplete examinations, we describe the findings of completion colonoscopy in 520 consecutive patients referred after incomplete examinations.

Methods

This study is a retrospective examination of a prospectively created database of all of the patients referred to DKR for previously incomplete colonoscopy. It was approved by the Institutional Review Board at Indiana University Health Partners on June 12, 2015. From July 2001 to March 2015, all patients referred to a single endoscopist (DKR) after prior unsuccessful attempts at cecal intubation by a gastroenterologist or a surgeon were included. They were identified from a colonoscopy database that contains all patients referred to DKR because of prior incomplete colonoscopy.

The database includes patient demographics, indications, methods of colonoscopy, duration of procedure, extent of prior colonoscopy and reasons for failure of cecal intubation for the prior colonoscopy. Serrated lesions were those read by the pathologist as sessile serrated polyps (sessile serrated adenomas), hyperplastic polyps, or traditional serrated adenomas.

The approach to colonoscopy in patients with prior failed colonoscopies was previously described and briefly summarized here.[7,9] Generally, standard adult colonoscopes were used for patients with redundant colons, and since 2008 with water immersion. Overtubes were used in cases where the above tools were unsuccessful. In patients with angulated or narrowed sigmoid colons as the cause of failed colonoscopy, pediatric colonoscopes were used in most cases but in

some cases a push enteroscope (usually the Olympus SIF-180, Olympus Corp, Center Valley, PA) or an upper endoscope was used. Again, water immersion was used routinely since 2008. Guide wire exchange was used in some cases if an upper endoscope was used to pass a difficult angulation but unable to reach the cecum.[15] Propofol was used for sedation in most cases; with monitored anesthesia care since February 2010.

Statistical analysis was performed using SPSS version 22 (IBM, New York, NY). Means and standard deviations were calculated for continuous variables. Ninety-five percent confidence intervals were calculated using the efficient-score method corrected for continuity.

Results

There were 520 consecutive patients. Mean age was 64.2 years (SD 11.2 y; range 17-93 y), and 355 (68.3%) were women. Prior incomplete colonoscopies were performed by gastroenterologists or surgeons. Referrals were made by a gastroenterologist in 370 cases (71.2%), a surgeon in 61 cases (11.7%), a primary physician in 68 cases (13.1%), and self-referred in 21 cases (4.4%).

Table 1 shows the indications for colonoscopy other than "prior incomplete colonoscopy". Reasons for failure of prior colonoscopy are shown in Table 2.

Colonoscopy was complete to the cecum (full exposure of the medial wall between the ileocecal valve and the appendiceal orifice) in 506 of 520 patients (97.3%). The mean time to cecal

intubation was 13.6 minutes (SD 9.3 min; range 1-57.7 min). The equipment relied on for cecal intubation and the maneuvers used are shown in Table 3. Water immersion was used in 352 patients (67.7%). Propofol (with or without other sedatives), administered prior to February 2010 by registered nurses supervised by the endoscopist (n = 127) and after February 2010 by Monitored Anesthesia Care (n = 254) was used in 381 total cases, with a success rate in cecal intubation of 97.1% (370/381). Opiods and benzodiazepines were used in the remaining 139 cases, with a cecal intubation rate of 97.8% (136/139).

A total of 913 conventional adenomas were removed in 277 patients, for an adenoma detection rate (ADR) of 53.3% and 1.76 adenomas per colonoscopy (APC). This includes a total of 184 advanced adenomas (> 1 cm in size or advanced pathology) removed in 101 patients, with an advanced adenoma detection rate of 19.4% and advanced adenomas per colonoscopy of 0.35. A total of 525 serrated lesions were removed in 175 patients, with 1.01 serrated lesions per colonoscopy (SPC). Of these, 54 lesions in 26 patients were read as sessile serrated polyps by the pathologists, including 10 that were ≥ 1 cm in size. In addition, there were 41 hyperplastic polyps ≥ 1 cm in size in 26 patients. Table 4 summarizes lesions found during colonoscopy by location. There were nine colorectal cancers found (3 with and 6 without lymph node metastases) including 2 in the cecum, 3 in the ascending, 1 in the transverse, 1 in the descending, and 2 in the sigmoid colon.

If only the 446 patients with no prior radiographic imaging study were considered, the ADR was 52.9%, APC 1.75, advanced adenoma detection rate 19.7%, and advanced adenomas per

colonoscopy 0.29. Table 5 shows that the yield of lesions was substantial for all colonoscopy indications.

Based on reported extent of the previous examinations, we estimated that approximately 57% of the adenomas, 58% of the sessile serrated polyps, 27% of the hyperplastic polyps, and all 9 cancers detected by the completion colonoscopy were beyond the extent of the previous examination (as opposed to reached but missed during the incomplete examination).

Of the 14 patients with incomplete examinations by DKR, there were 8 patients with diseased colon segments that could not be passed or which provided "fixed resistance" to scope passage after being passed. The anatomic diagnoses in these 8 patients were ischemic colitis with stricture (n=1), sigmoid fixation after pelvic surgery (n=1), obstructing colon cancer (n=1), NSAID induced stricture (n=1), radiation stricture (n=1), diverticulitis related stricture (n=2), and intra-abdominal metastases from breast cancer (n=1). Two patients had abdominal wall hernias that could not be reduced prior to starting the procedure. In both cases the colonoscope tip could pass the distal point of the herniated transverse colon but could not pass the proximal point of the herniation despite manual attempts to advance the colonoscope through the herniated bowel. Four patients had intractable looping as the cause of failure. Two of these four patients had a second attempt by DKR at cecal intubation at later dates, and both repeat attempts by DKR were successful. These two patients were the only patients of the 14 failed procedures in whom DKR attempted cecal intubation two or more times on different days.

Discussion

In this report we describe the largest experience of patients referred for completion colonoscopy after a prior incomplete examination. We previously described methods used to complete a colonoscopy after prior attempts at intubating the cecum had failed.[7,9] In a population of 520 consecutive referred patients, we again found that in patients with a prior incomplete colonoscopy, cecal intubation can be achieved with routine equipment and maneuvers in the overwhelming majority (97%). In this report we describe the yield of neoplasia during completion colonoscopies at a referral center. These data are relevant to whether establishment of regional referral centers for complex colonoscopies is warranted.

The yield of completion colonoscopy in this cohort was substantial, with 53% having at least one conventional adenoma, 19% having an advanced conventional adenoma, 5% having a sessile serrated polyp, 5% having a hyperplastic polyp $\geq$ 1 cm, and 1.7% having cancer. We estimated that more than half of the neoplasia detected at completion colonoscopy was proximal to the extent of the previous incomplete examination as opposed to reached but missed during the prior examination. In this study 78% of advanced conventional adenomas and 77% of the sessile serrated polyps were estimated to be proximal to the splenic flexure (Table 4), supporting the suggestion that a very high yield for completion colonoscopy results mostly from achieving access to the proximal colon. After removing patients referred for abnormal imaging tests, the yield of neoplasia from completion colonoscopy was still very substantial. Thus, these data support the value of establishing regional expertise in complex colonoscopy, and that referral directly to the regional center without intervening radiographic imaging is reasonable and appropriate.

Some previous studies have described techniques and yields of repeat colonoscopy in patients with prior incomplete colonoscopies [6,16-31]. Our series has several strengths, including its large size (this series accounts for more than half of all reported cases) and referral of all cases from other gastroenterologists and surgeons. We also excluded patients with prior incomplete examinations because of inadequate preparation, a policy followed in most but not all series (Table 6). Thus, nearly all patients in our series had a structural cause (a redundant colon with looping or an angulated sigmoid colon) underlying the prior incomplete colonoscopy. Despite that, colonoscopy was completed in the overwhelming percentage of cases (97%) entirely with widely available endoscopes not including double or single balloon enteroscopes. Although double and single balloon enteroscopes have become the mainstay of completion colonoscopy in some centers (Table 6), our series demonstrates that high rates of completion are achievable without these specialized endoscopes, which are still not widely available. The addition of water immersion to standard colonoscopy techniques has greatly simplified the procedure when the cause of the prior failure is a redundant colon [9]. The use of standard colonoscopes may provide an advantage over single and double balloon enteroscopes when complex polypectomies must be completed after cecal intubation. We're uncertain whether the 14 cases in this series in which colonoscopy was not completed might have been successfully intubated to the cecum using balloon enteroscopes. The best approach for the regional center for complex colonoscopy may be to have one or more colonoscopy experts skilled in the use of both conventional and balloon instruments.

Limitations of this study include the selection bias associated with the referral system. However, some degree of referral bias would be expected in any regional center for complex colonoscopy.

Further, the yield remained high after exclusion of patients with positive radiographic imaging studies, the most obvious source of referral bias. Second, the location of polyps and whether they were proximal to the extent of the prior colonoscopy can only be estimated for many lesions. Therefore, our estimates of the fraction of lesions not reached vs. reached but not detected are just that, i.e. estimates only. The proximal colon location of most of the advanced lesions suggests that many were proximal to the extent of the previous examination. Next, review of the serrated lesions by an expert pathologist might increase the number of sessile serrated polyps identified, but would not change the overall conclusions. Finally, all of the colonoscopies in this study were performed by a single expert, but this scenario may be expected in some regional centers for complex colonoscopy [16].

In summary, regional centers for complex colonoscopy can provide high rates of cecal intubation in cases of incomplete colonoscopy and high yields of neoplasia in these cases. The regional center for complex colonoscopy is an important medical service.

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Table 1. Indications for colonoscopy in 520 consecutive patients referred for incomplete colonoscopy

Indication	Frequency (%)
Screening or surveillance of polyps	296 (56.9%)
Abnormal CT colonography or barium enema	74 (14.2%)
Therapy of visualized polyp	21 (4.0%)
Surveillance for history of colorectal cancer	13 (2.5%)
Anemia or gastrointestinal bleeding	99 (19.0%)
Inflammatory bowel disease	17 (3.3%)

Table 2. Reasons for failure to complete prior colonoscopy in 520 patients.

Reason for failure	Frequency
Looping/redundant colon	280 (53.8%)
Sigmoid fixation/angulation	202 (38.8%)
Both sigmoid angulation & looping colon	30 (5.8%)
Issues with sedation	8 (1.5%)

Table 3. Equipment and maneuvers critical to cecal intubation in 505 patients

Equipment used		
	Adult colonoscope	278 (55.0%)
	Pediatric colonoscope	119 (23.6%)
	Upper endoscope	35 (6.9%)
	Enteroscope	24 (4.7%)
	Overtube with any scope	30 (5.9%)
	Guidewire exchange	19 (3.8%)

Table 4. Location of resected polyps and cancers

	Tubular adenoma		Tubulovillous adenoma		Villous adenoma		Hyperplastic polyps		Sessile serrated polyps		Colorectal cancer
	<1 cm	≥1 cm	<1 cm	≥1 cm	<1 cm	≥1 cm	< 1 cm	≥ 1 cm	< 1 cm	≥ 1 cm	
Cecum	97	17	0	4	0	0	26	6	1	1	2
Ileocecal valve	8	4	0	3	0	0	0	1	0	0	0
Ascending colon	215	31	20	16	0	0	42	9	28	7	3
Hepatic flexure	12	3	1	0	1	1	2	0	1	1	0
Transverse colon	177	17	10	13	0	0	74	9	4	0	1
Splenic flexure	5	0	0	1	0	0	1	0	0	0	0
Descending colon	109	5	2	4	0	0	28	1	6	1	1
Sigmoid colon	89	6	5	9	0	0	113	10	2	0	2
Rectum	21	4	0	3	0	0	144	5	2	0	0

Table 5. Yield of repeat colonoscopy at our center by indication

Indication	Non-advanced adenomas	Adenoma detection rate (%)	Advanced adenomas	Advanced adenoma detection rate (%)	Sessile serrated polyps	Hyperplastic polyps ≥ 10 mm	Cancer
Screening or surveillance n=296	476	59.5	131	21.3	21	24	4
Abnormal imaging n=74	100	54.1	21	17.6	16	6	1
Polyp visualized but not reached n=21	69	85.7	20	57.1	8	9	1
History of colorectal cancer n=13	13	53.8	4	23.1	0	0	1
Bleeding (anemia, occult blood) n=99	64	30.3	7	9.1	7	1	2
Inflammatory Bowel Disease n=17	7	35.3	1	5.9	2	1	0

Table 6. Patients, instruments and success rate of repeat colonoscopy in patients with prior incomplete colonoscopies

Author/ reference	Year	Number of Patients	Largely referred from outside institutions	Success in intubation (%)	Balloon enteroscope or other special scope	% with poor preparation as a cause of failure	ADR (%)
Bick/ current	2015	520	Yes	97.3	No	0	53.3
Ridolfi [6]	2014	79	No	NS	No	34	24
Becx [17]	2014	114	No	88.6	Yes	0	42.1
Nemoto [18]	2014	28	No	100	Yes	0	NS
Brahmania [16]	2012	90	Yes	96.6	No	11	NS
Keswani [19]	2012	70	NS	97.1	Yes, in 19.1%	NS	31.4
Hotta [20]	2012	110	No	100	Yes	0	50
Keswani [21]	2011	30	No	92.9 50	Yes No	0	11.8
Matsushita [22]	2011	23	NS	95.6	Yes	NS	NS
Schembre [23]	2011	24	No	92	Spiral overtube	No	54.2
Coppola [24]	2011	79	No	93.6	Push enteroscope	0	31.6
Teshima [25]	2010	23	Yes	96	Yes	NS	PDR 26.1
Moreels [26]	2009	45	No	93	Yes	0	PDR 43
Shida [27]	2008	52	No	88.5	Gastroscope with cap	0	NS
Mönkemüller [28]	2007	7	NS	100	Yes	0	43
Pasha [29]	2007	16	No	85.7	Yes	0	PDR 37.5
Gay [30]	2007	29	NS	96.5	Yes	NS	PDR 26.1
Kaltenbach [31]	2006	20	No	95	Yes	0	25

ADR: adenoma detection rate
PDR: polyp detection rate
NS: not stated